STATE OF ILLINOIS
DEPARTMENT OF REGISTRATION AND EDUCATION
STATE GEOLOGICAL SURVEY DIVISION

Morris M. Leighton, Chief

HARRISBURG AREA

Harrisburg and Brownfield
Quadrangles

Guide Leaflet 51-A

by
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Urbana, Illinois
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PART I. ITINERARY

0.0 0.0 Caravan assembles headed east on North side of Harrisburg Township High School.

0.0 0.0 Turn right (S).

0.4 0.4 Turn left (E).

0.3 0.7 STOP NO. 1. Brick Works Office.

Red brick and tile are being made here from Pennsylvanian ("Coal Period") shale that lies above the Herrin (No. 6) Coal Bed.

0.0 0.7 Resume route; turn right through plant yard.

0.2 0.9 Turn left on road way and cross R.R.

0.1 1.0 Stop Sign. Cross Route No. 45 and continue east.

0.3 1.3 Stop Sign. Turn right (S) on Route No. 34.

0.3 1.6 Enter Pankeyville.

0.6 2.2 Turn left (E) on Ingram Hill Road.

0.2 2.4 STOP NO. 2. Strip Coal Mine.

Mining operations here were in the Herrin (No. 6) Coal. As indicated in the debris of the strip piles, several inches of black carbonaceous shale overlay the coal and was followed by gray cap rock limestone interlensed with gray marine shale. Above this and under alluvial deposits of Pleistocene (Glacial Period) Age, was a varying thickness of gray, silty non-marine shale, as was seen in the brick-works clay pit (Stop No. 1). Below the coal was a gray, non-stratified underclay.

The black slate here yielded no fossils but commonly rock of this type contains fossils indicating an environment in which certain special forms of marine animals were able to live. In general the habitat may have been in the nature of brackish coastal lagoons often with the stagnant poisonous bottom waters.

The limestone and marine shale above the black "slate" was deposited under conditions of freely circulating sea waters, so that such typically marine animals as crinoids ("sea lilies"), bryozoa, brachiopods, and even small corals were able to live here.

The marine shale and limestone grades upward into shales and sandy shales in which no marine fossils are present and only the remains of land plants are rarely found. Evidently sediments washed from the lands of the time filled the shallow sea and caused a retreat of the coast line.

The coals themselves are believed to have been deposited in great fresh water swamps of a low coastal plain, and the underclay is thought by many to have been an ancient soil in which the coal forests grew.

Conditions changed frequently and were many times repeated during the millions of years that went to make up the Coal Period (Pennsylvanian Period). Although most of the 2000 feet or more of coal bearing strata are made up of non-marine shales and sandstones, thin limestones, marine shales, coal beds, and underclays, occur again and again in the succession of sedimentary layers.

0.0 2.4 Resume route - continuing ahead.

0.3 2.7 Turn right (N) on road to old mine, loop right, and retrace course to Route No. 34.

0.8 3.5 Stop. Turn left (S) on No. 34.

0.9 4.4 STOP NO. 3. View southeast to Shawneetown "Fault Scarp".

From this point we look southeast across an ancient lake flat (see Stop 4) to the high range of hills running from Williams Hill on the right through Bald Knob and Cave Hill and eastward to the Wildcat Hills and beyond.

Most of Illinois, very flat on the surface is a spoon-shaped basin so far as the attitude of the rock layers is concerned. The steep part of the spoon is at its south end and here layers come up out of the basin to crop out at the surface. Coal No. 6 for example lies below sea level in the northern part of Saline County and rises steeply to come to the surface south of Harrisburg (as at Stop No. 2).

Intense movements of the earth's crust in the distant geologic past caused the southeast tip of Illinois to move northwestward against the south end of the coal basin. This segment of the crust moved along a rupture or fault (Shawneetown Fault) which lies today at the base of the range of hills. The fault movement brought to the surface hard massive sandstones of early Pennsylvanian age, of which the hills are made.

1.9 6.3 STOP NO. 4. Park along highway.

Road here descends low bluff to Saline River flats. The river here does not flow in a flood plain of its own making. The flats are underlain by clay and silt deposited in the bed of an ancient lake. The lake existed late in the Ice Age and came about as follows:

The Mississippi River was carrying a great deal of water and sediment in the form of mud, sand, and gravel washed out from a melting glacier that stood in the upper Great Lakes and Red River Valley. The Ohio River, on the other hand, was not carrying glacial melt waters.

The Mississippi built up its flood plain to a great height and thus dammed back the tributary Ohio River, which virtually became a long, narrow lake, with arms that extended up the tributaries, such as the Saline River Valley. Mud and sand that washed into the lake eventually filled it and buried the bases of many of the hills, like that lying a half mile to the southeast. The old lake flat lies 360 to 370 feet above present sea level.

Much earlier in the Ice Age, the Illinoian glacier just about reached the point where we stand. This can be determined by the distribution of boulders of rock found today only in the far norhtern regions from which the glaciers came. South of here, in the Shawnee Hills, the region never has been glaciated, and no such boulders occur.

1.0 7.3 South Fork SALINE RIVER.

0.7 8.0 Enter Mitchellsville.

0.4 8.4 Forks; take right fork, leaving pavement.

1.6 10.0 For next 0.4 mile road ascends steep grade through cuts in sandstone of Pennsylvanian, Tradewater age.

0.4 10.4 STOP NO. 5.

As we go downward in the Pennsylvanian strata below the main productive coal measures, the strata become increasingly sandy. The most productive of the coal measures are called the Carbondale Group. Under this lies the much sandier Tradewater Group, hundreds of feet thick.

The sandstone in the highway cut is a part of this Tradewater Group. It can be seen to lie in parallel strata sloping gently northward, as the beds are here sloping downward toward the center of the Illinois Coal Basin. Near the summit of the grade, the strata are broken and south across the small gully they can be seen to slope steeply southward. The draw itself is the site of a fault zone, here a minor rupture of the earth's crust, where a block to the south settled downward at some time in the distant past. The rock was highly shattered close to the fault and thus easily eroded to form the small gully. The strata south of the gully were dragged from a nearly horizontal position as the southern block dropped downward.

0.9 11.3 Cross bridge over tributary of Battle Ford. Pennsylvanian Sandstone in cut north of bridge shows excellent vertical joint planes (Murray Bluff Sandstone).

1.7 13.0 CEDAR BLUFF CHURCH.

0.2 13.2 Road east to Williams Hill and Herod. The attractive skyline drive affords fine views of the Shawnee Hill country and the plains to north. Williams Hill, over 1060 feet high, is the highest point in southern Illinois.

Sandstone ledges in road cut are of Pennsylvanian, Tradewater age (Delwood) and show excellent cross-bedding.

0.5 13.7 Turn right (W) on road to McCormick Tower and Belle Smith Spring.

2.8 16.5 STOP NO. 6. Flat Rock School.

The road has been following a high divide which is the edge of a north-facing cliff or escarpment. This escarpment is made by thick layers of Caseyville sandstone which is here brought to the surface as a result of the erosion of a sharp up-fold in the strata. This upfold is called the McCormick anticline, and runs from Cedar Bluff southwest to McCormick, beyond which it passes into a fault.

The hills to the north are produced by hard strata in the upturned edge of the Illinois Coal Basin. These strata dip north until they lie at a great depth under the plains of the Coal Basin.

Most of the hills to the north rise to heights of between 600 and 700 feet. This level was once a continuous rolling plain, called the Lancaster or Ozark Peneplain, which had resulted from the erosion of the region down to base level. Then a limited uplift of the entire region enabled the streams to cut down below the level of the old peneplain, and the region was once again dissected into a complex of ridges and valleys, as we see it today.

The skyline ridge and hill summits to the south are in hard massive sandstone that rose as low hills, about 100 feet above the old peneplain level. Their flat summits, all rising to about the same general level, may be the last remnants of what was once a still higher and still older peneplain.

2.0 18.5 STOP NO. 7. Descend to Burden Falls.

The stream descends in about a 40 foot vertical drop over Pennsylvanian, Caseyville sandstone where erosion has cut a canyon back one-half mile into the escarpment formed by the McCormick anticline. Numerous quartz pebbles may be seen in the sandstone. Such pebbles are typical of basal Pennsylvanian beds over much of eastern North America. They seem to have been developed on a land surface during the time interval that separated deposition of Mississippian and Pennsylvanian strata in the region.

0.5 19.0 Road junction south of McCORMICK FIRE TOWER. Turn left (S) along ridge top.

1.5 20.5 Junction. Turn left (W) on road to Belle Smith Spring.

1.5 22.0 Forks. Go left to Belle Smith Spring parking area.

0.7 22.7 LUNCH STOP. Go back up road a short distance to trail that descends bluff to west.

STOP NO. 8. The same sandstone seen at Burden Falls is present here. This is the Caseyville sandstone the lowest group or division of the Pennsylvanian strata. At the time this sandstone was being deposited in Illinois, very high mountain ranges were rising along what is now the Atlantic Seaboard. As the mountains rose, erosion tore away the exposed strata and great streams carried the sediments westward across the low country, which it buried under hundreds of feet of sand.

That this sand was deposited above sea level is indicated by the fact that no marine fossils are found in the Caseyville sandstone but only the remains of land plants, which may either have lived here or floated here from the eastern high lands. In one of the sandstone blocks used to pave the stairway that descends through the narrow rock crevice to the picnic grounds, the impression of an ancient log may be seen. This has leaf scars arranged in parallel rows separated by pleat-like ridges. This indicates the tree to have been a Sigillaria, a species of club moss, whose modern relatives stand seldom more than a foot high in our modern forests.

The gorge of Bay Creek has been eroded back from the Chester Escarpment, which we will see at Stop No. 9 and which marks the southern limit of the Pennsylvanian outcrop. It is obvious that large vertical cracks in the massive sandstone have aided the forces of erosion in cutting the

gorge and side gullies. Joints differ from faults in that, while the rock is broken, no movement has taken place between the sandstone masses. The development of joints may be compared to the cracking of safety glass. Rock layers, like sheets of glass, are brittle, especially when deeply buried and thus under heavy pressure. A slight twist in the earth's crust will cause the layers to shatter in a pattern of cracks, but the individual pieces (joint blocks) remain in place.

As the waters of the stream undermine the cliffs, the joint blocks topple into the valley. Rarely a block will be completely worn through in the middle but remain standing as an arch, while a weaker block behind it crumbles away. Thus a "natural bridge" like that south of the picnic ground, is developed. This is one of two natural bridges in Illinois.

A large fallen block north of the bridge and on the opposite side of the stream has its surface covered with ripple marks, indicating that the sandstone originated as sand deposited in shallow standing water, perhaps a large bayou lake.

Some large blocks instead of toppling have slipped sideways away from their original position. This has probably been caused by a slippery shale zone now concealed below the sandstone masses. The existence of springs close to stream level also strongly suggests the presence of a shale stratum.

Sandstone is very porous and water circulates through it freely; but on reaching the impervious shale, the water moves laterally to come to the surface as springs wherever erosion has cut down through the sandstone-shale contact.

0.0 22.7 Retrace route to junction with Eddyville Road.

2.2 24.9 Junction with Eddyville road. Turn right (S).

0.7 25.6 WATKINS FORD over Bay Creek. Ascend steep hill beyond to ridge summit and take left fork, keeping on upland.

3.5 29.1 STOP. Turn right (S) on Route No. 145. Pennsylvanian (Tradewater) sandstone exposed in cuts for next mile.

1.2 30.3 About 5 feet of sandstone on 25 feet of gray shale and sandy shale. (Probably Grindstaff sandstone on uppermost shale of the Pounds formations.

1.7 32.0 Caution. Cross EDDYVILLE blacktop road.

1.8 33.8 For next mile, road runs close to edge of Chester escarpment.

1.0 34.8 STOP NO. 9. Long grade descending Chester Escarpment.

The thick solid sandstono that lies at the base of the Pennsylvanian rests on a series of weaker strata below that are of Mississippian, Chester age. The Chester strata therefore, erode rapidly and cliffs or steep ridges are cut back to the protecting basal Pennsylvanian (Caseyville) sandstone, which forms the cap rock of the escarpment. Only a few feet of Caseyville sandstone remain at this place, at the very top of the cut, above the streak of pale silty sandstone. The Caseyville here is coarse and poorly sorted and has many rounded pebbles of milky quartz. It makes an irregular contact with the rock beneath, cutting down into the underlying layers. There are many pockets of red clay along this line of contact.

After the deposition of the last Mississippian sediments, the region was uplifted to a land area and subjected to erosion. The rocks weathered and soils formed. Only such hard and nearly insoluble rocks as quartz and chert remained on or near the surface. As the land sank again early in Pennsylvanian time, sediments again were deposited over the former upland surface, and what ever materials had accumulated there were incorporated in the sediments at the base of the Pennsylvanian.

The Mississippian layers in the region total near 3000 feet. The lower half is mainly thick formations of marine limestone, with black carbonaceous shale at the base. This "Iowa Group" of strata does not reach the surface in the field trip area.

The upper division of the Mississippian, the Chester Group, consists of an alternating series of rather thin formations of sandstone and of limestone and shale. In Chester, as in Pennsylvanian time, there was thus an alternation of marine and non-marine conditions, with this difference. Few if any of the Chester strata seem to have been deposited under land conditions. The non-marine sandstones and shales appear to have been laid down in lakes or estuaries that were partly cut off from the sea and the waters of which were kept fresh by the influx of large streams. The environment may be comparable to that of the present west coast of Florida north of the Everglades.

Except for the lowest sandstone (Degonia) seen near the base of the long grade, the strata below the base of the Pennsylvanian here all belong to the KinKaid Formation of the Chester Group. At top is about 12 feet of sandstone in thin layers without pebbles. The next rock to be seen is varicolored clay shale, which carries a spring line at the upper contact, and is about 40 feet thick. Below this is about 40 feet of sandstone, above another varicolored clay body, which grades downward into a highly siliceous and cherty, black, brown weathering limestone. The limestone has many fossils, including brachiopods, bryozoa, and gastropods (snails), indicating marine conditions. When the rock weathers, the calcium carbonate leaches away leaving a light weight, spongy rock that is a siliceous skeleton of the originally siliceous limestone.

Below the limestone is more clay and shale and finally the top beds of the underlying Degonia sandstone.

1.0 35.8 Bridge over Hayes Creek.

0.3 36.1 Cut in dark green KinKaid shale.

1.1 37.2 Cut in dark green Kinkaid shale.

0.5 37.7 "Y" Highway junction; curve left.

0.5 38.2 Junction with blacktop highway; continue left (S).

0.1 38.3 Bridge over Hayes Creek.

0.1 38.4 GLENDALE. Outcrops of Degonia (Chester) sandstone. Continue ahead (S).

1.4 39.8 University of Illinois Agricultural Experiment Station on left. Outcrops in next mile are Chester sandstone.

1.4 41.2 Cross Sugar Loaf Creek.

0.1 41.3 Road east goes to Lake Glendale. Continue ahead (S).

1.5 42.8 STOP NO. 10. Park along highway.

Fault in Chester strata. Most faults are poorly exposed because the shattered strata along the fault zone weather readily, so that a small valley commonly conceals the actual fault. The present locality is exceptional in preserving full details of the faulting.

The thin bedded sandstone strata standing nearly vertical are the Tar Springs Sandstone. Note the ripple marks, made when the horizontal layers were being deposited as sand on the floor of a lake or estuary.

The nearly vertical shale layers west and north of the sandstone strata belong to the Vienna Formation, which normally should lie below the Tar Springs. Notice that the shale beds are not exactly parallel to the sandstone beds (i.e. have a somewhat different "strike"). Also masses of shale have been shoved between sandstone layers indicating there was some horizontal movement along the fault.

Bands of clay full of sandstone fragments are "fault gouge" where the strata were ground up by the faulting.

On the opposite side of the road, away from the fault, the strata may be seen to dip rather gently; the same is true as one goes northward along the east side of the road and thus farther away from the fault zone.

This fault is one of many which cut the Illinois-Kentucky fluorspar district into a complicated mosaic of long narrow fault blocks. These faults are not to be confused with the Shawneetown fault farther north (Stop No. 3) which developed at an earlier date.

The fault mosaic of Pope and Hardin counties is thought to have developed first as the result of the doming of the region, probably because of the intrusion at great depth of a mass of molten magma (igneous rock material, called lava when it comes to the surface). Although such an igneous body has never been reached, many dikes of igneous rock (peridotite) cut the strata in this region. These dikes are doubtless off-shoots of the main mass.

After the strata of the region has been shattered by doming, the dome collapsed, and a second period of faulting took place. The collapse may have been due to a partial withdrawal of the igneous mass. Nevertheless, gaseous and vaporous emanations continued to rise along crevices and especially along some of the fault zones. As the vapors chilled on approaching the surface the valuable fluorspar-zinc-lead-silver ores were deposited in the crevices.

All these events took place some time after the Pennsylvanian and before the Cretaceous period.

0.5 43.3 Mississippian (Tar Springs) Sandstone, in nearly horizontal layers.

0.2 43.5 Tar Springs Sandstone layers with southerly dips on shale.

0.1 43.6 Caution. Pass over Route No. 146; stop sign beyond. Continue ahead (S) on No. 145.

2.0 44.6 RENSHAW. Park along pavement and ascend small road left, to bluff top.

STOP NO. 11. Cache Valley.

We are looking south westward down the Valley of the Ohio River. There is no river here today because in the not distant geologic past the Ohio escaped from its own valley and broke over into the valleys of the Cumberland and Tennessee rivers, which it follows today in its course from Bay City to Cairo, to join the Mississippi there. Cache Valley which you see before you is almost exactly as the river left it, roughly a score of thousands of years ago.

Cache Valley as we see it today is filled with alluvium deposited there by the Ohio up to the time it abandoned this channel. The valley that the river actually cut down into the hard bedrock is much deeper, down to 175 feet above sea level at Ullin. Thus 165 feet of alluvium partially fills the old valley. The new valley (the valley originally cut by the Tennessee River), although cut in soft coastal plain sediments was not excavated to so great a depth, reaching only to about 250 feet above sea level at Mound City.

Late in the Ice Age, the valley of the Mississippi was filled to great depth with sand and gravel washed out from the melting glaciers to the north and the valleys of the Ohio and Tennessee filled up to the same level with slack water silt and clay. This equalized the difference in the depths of the original valleys and made it easy for the Ohio to break through a low divide and capture the lower valley of the Tennessee.

The past was restored briefly in 1937 when during the Great Flood the Ohio rose so high that a part of its waters spilled out through the old Cache Valley.

0.0 44.6 Continue ahead (S) on No. 145.

0.1 44.7 Caution - RR Crossing.

4.7 49.4 Ledges of Chester (Hardinsburg) sandstone dipping steeply because of proximity to a fault.

0.1 49.5 Horizontal ledges of Hardinsburg sandstone.

1.1 50.6 STOP NO. 12. Park along highway on hill near junction with Round Knob Road (right).

Gravel Pit in LaFayette Gravel on Cretaceous sand.

In a general way, Cache Valley forms the boundary between the Shawnee Hills region of older, solidified, disturbed and faulted rocks to the north and younger, unconsolidated, nearly flat lying rocks of the Gulf Coastal Plain to the south. The unconsolidated rocks in the gravel pit belong to the Gulf Coastal Plain region. Here at the north edge of the plain, the region has been dissected into low hills and gullies.

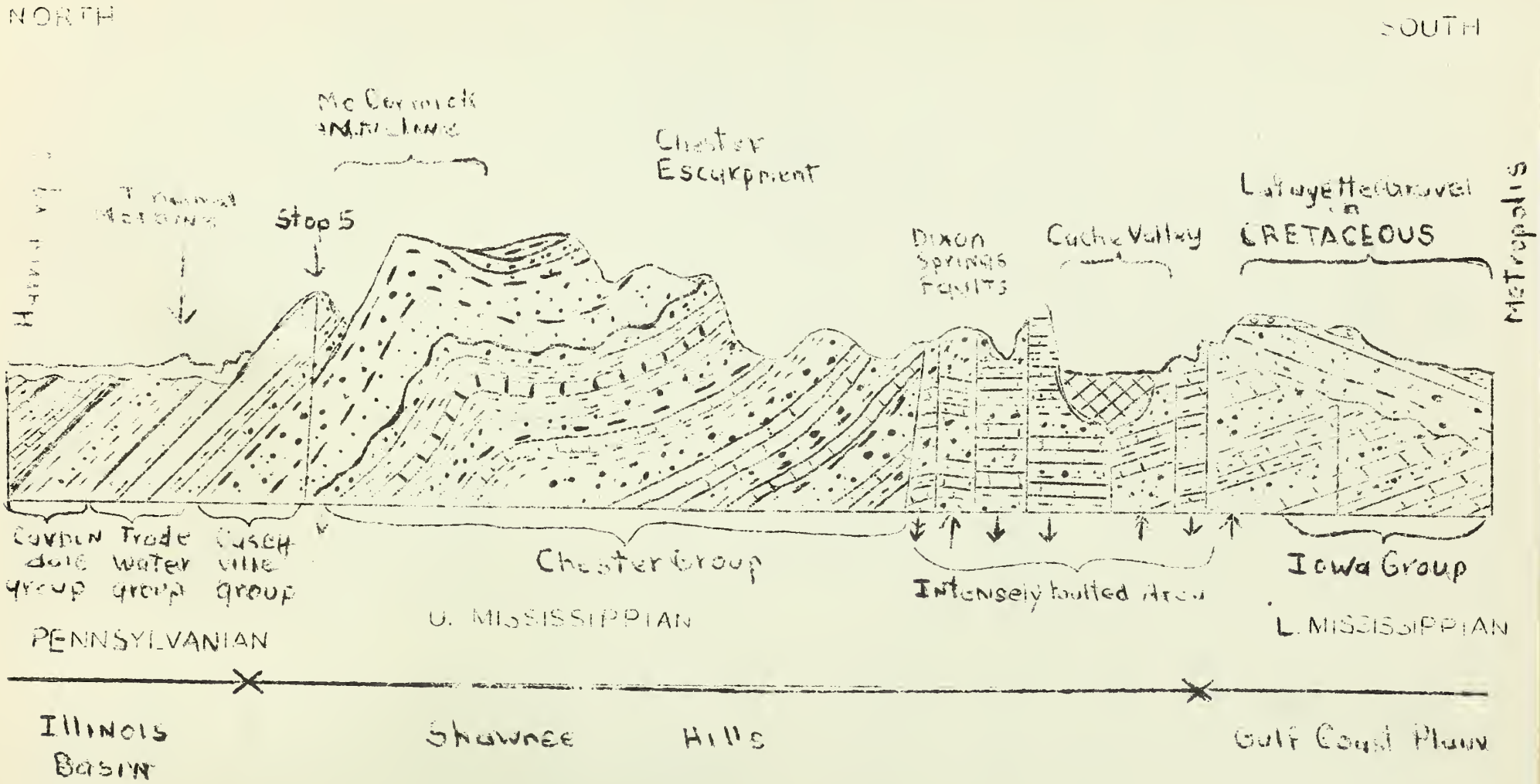
The gravel in the pit consists of rocks, mainly chert, that have been washed off the high lands to the north, as is indicated by the common presence of Mississippian fossils in the chert. Although the deposits were evidently laid down by streams, two features of these "LaFayette Gravels" remain unexplained. They do not so much occur in channels as in widespread blanket deposits, and the pebbles are always highly polished. The gravels were laid down before the Ice Age (Pleistocene) but after the withdrawal of the Tertiary Sea in Eocene time.

The upper couple feet of the gravel is deeply weathered to a residual clay, with only a few pebbles remaining. This indicates long exposure under upland conditions. Above the clay are two or three feet of loess, "dust" that settled here during the Ice Age as the frigid winds swept up the fine sediments from the alluvial flats of the Mississippi and the Ohio-Cache to the West. The upper foot of loess has been altered to a lean forest soil.

At the south end of the pit, loose red sand is exposed below the gravel. This sand, of Cretaceous age, is much older than the gravel and was deposited in the Gulf Embayment which extended this far north in Cretaceous and Eocene time. Today the sediments of the Mississippi and its tributaries have filled this embayment as far as the present delta below New Orleans.

Thus the line between the Cretaceous sand below (deposited in the days of the dinosaurs) and the late Tertiary gravels above represents a great span of geologic time. Such a line geologists call a "hiatus," commonly also an "unconformity."

End of Trip - Bon Voyage.



GENERALIZED CROSS-SECTION FROM HARRISBURG TO METROPOLIS

GENERALIZED GEOLOGIC COLUMN
HARRISBURG AREA
Prepared by the Illinois State Geological Survey

ERAS		PERIODS	EPOCHS	FORMATIONS
Cenozoic "Recent Life"	Age of Mammals	Quaternary	Pleistocene	Cache Valley; Stop 11 Lake Deposits; Stop 4 Illinoian Till; Stop 4 Loess; Stop 12
		Tertiary	Pliocene	La Fayette Gravel; Stop 12.
			Miocene Oligocene Eocene Paleocene	Not present in field trip area.
Mesozoic "Middle Life"	Age of Reptiles	Cretaceous		Stop 12.
		Jurassic		Not present in Illinois
		Triassic		Not present in Illinois
Paleozoic "Ancient Life"	Age of Amphibians and Early Plants.	Permian		Not present in Illinois.
		Pennsylvanian	McLeansboro	Beds above Coal 6; Stops 1&2
			Carbondale	No. 6 Coal - Stop 2
			Tradewater	Stop 5.
			Caseyville	Stops 7, 8, 9.
		Mississippian	Chester Group	Stops 9, 10.
			Iowa Group	
	Age of Fishes	Devonian		Deeply buried in field trip area
	Age of Invertebrates	Silurian		Deeply buried in field trip area
		Ordovician		Deeply buried in field trip area
		Cambrian		Deeply buried in field trip area
		Pre-Cambrian		Deeply buried in field trip area

PART II. GEOLOGIC HISTORY OF HARRISBURG-METROPOLIS AREA

In going from Harrisburg south to Metropolis, the route begins in the Illinois Coal Basin, crosses the Shawnee Hills, and terminates on the Gulf Coastal Plain. Each of these three geological districts has different characteristics and a different history.

DEEPLY BURIED FORMATIONS.

The oldest rock to crop out in the area, strata of Mississippian Age, comes to the surface in the Shawnee Hills. But much older strata lie buried below the Mississippian and younger rocks. This we know from the fact that, as we go westward older and older strata come to the surface, until in the St. Francis Mountains of Missouri there is exposed the granite foundation over which all of the stratified bedrock layers of the Illinois crust have been laid down. The granite foundation or basement is by no means the original crust of the earth, but consists of rock so old and so distrubed and altered by ancient disturbances that it has lost its bedded character and been cut by injections of molten rock from deep in the crust. Before the ancient Paleozoic seas came to Illinois, this basement was worn to a nearly flat plane by erosion acting through an immense span of time.

The layered bed rock in Illinois, from the Cambrian Period through the Devonian, was deposited as sheet upon sheet of sediment, largely over the floors of ancient seas that inundated the interior of the continent. These sheets of sand, clay, and lime mud in time hardened into the sandstone, shale, and limestone bedrock, which encloses the fossil remains of the animals that inhabited the ancient seas. Deep wells in the region today penetrate deep into these ancient strata.

MISSISSIPPIAN SYSTEM.

The Mississippian Sea also spread widely into what is now the Mississippi Valley, and in its early stages deposited many thick limestones, probably in rather deep waters. Later, indications are that the crust in this region became somewhat unstable with perhaps an alternating rising and sinking; so that at times the bulk of the land lay below sea level, at other times bars and deltas built out from the coastline and fresh-water or brackish bays, lagoons, and estuaries were developed. Finally there was a general warping of the earth's crust and a general rise of the land out of the sea, followed by erosion of the higher areas.

PENNSYLVANIAN SYSTEM.

The rising tendency of the North American Continent, which began toward the end of Mississippian time continued more strongly into Pennsylvanian time in the East, as high mountains rose along the Atlantic seaboard. The sediments stripped by erosion in vast quantities from these rapidly rising heights were carried westward by great rivers to the ocean, an arm of which continued to exist in the southwest in the region of Oklahoma and Texas. Thus great masses of sandstone and shale were deposited across the intervening lowlands (including Illinois), which might be compared with the present Amazon Basin at the foot of the towering Andes.

As the great mass of sediment accumulated in the lowlands, it tended to depress the underlying earth's crust to a sufficient degree to allow the sea to spread over the lowlands for limited periods. Then an increased dumping of sediment from the highlands would fill the basin and once again shut out the sea. As the periodic sinkings began, there seem to have been stages, before the flooding by the sea, when the region was covered by immense fresh water swamps. These were surrounded and covered by a rank tropical vegetation of ferns, horsetails, and club moss trees, forming dense cane breaks. When the vegetation died it fell into the shallow but sediment-free water and was thus protected from complete decay. These peat-like masses eventually hardened into valuable coal seams.

The first known amphibians and the earliest of reptiles lurked in these swampy jungles, when the oldest known insects hung in the miasmic air. The Pennsylvanian is the first period in Earth's history in which plants and animals moved from the sea to the land on a large scale.

POST-PENNSYLVANIAN DISTURBANCES:

Probably at the close of Permian Time, when the Appalachian Mountains were rising in the East, different segments of the earth's crust in the Illinois region began to move slowly up or down. An area embracing the major part of Illinois slowly sank to produce the rich Illinois coal and oil Basin. The southeast tip of Illinois, on the other hand, along with the adjoining parts of Kentucky rose relatively to an immense stratal dome. As the differential between the dome and the basin became greater and stresses increased, the dome was thrust northwestward, with the resulting formation of the great Shawneetown fault and the weaker McCormick anticline (an upfold, in the nature of an immense crease). The resulting release of pressure (tensional effect) may have permitted the intrusion, deep underground, of an immense mass of molten rock magma (called lava when it reaches the surface). This further expanded the dome in an intricate set of breaks, or faults. Some of the magma rose through these breaks and crevices as high as the Mississippian and Pennsylvanian strata. (Some coal beds have been locally baked by the intense heat of this magma material). These crevice fillings hardened to a dark crystalline rock called peridotite.

Probably owing to the later withdrawal of part of the molten subterranean rock mass, the dome partially collapsed and new fault breaks developed in the strata, as great blocks of the crust wedged downward. Nevertheless, much slowly cooling and solidifying magma must have remained below from which vaporous emanations and boiling waters rose along the crevices to deposit valuable veins of fluorspar-lead-zinc-silver.

THE ANCIENT GULF OF MEXICO.

Following the crustal disturbances that took place not long after the Coal Period in Illinois, there followed a long quiescent period during which erosion was busy cutting away the rock strata from the high areas and carrying the debris to the low places as sediments. Thus thousands of feet of Pennsylvanian strata, including many millions of tons of coal, were stripped from the Shawnee Hills, where the older Mississippian strata were laid bare.

By this time the interior of North America had assumed the general conformation that it has today. Doubtless an ancestral Mississippi extended through the drainage basin of what are now the valleys of the Missouri, Upper Mississippi, Illinois, and Lake Michigan. The Gulf of Mexico extended north to include the tip of Illinois. By Cretaceous time, the sediments brought down the ancient Mississippi began to fill the upper end of this Gulf of Mexico embayment and a coastal plain began to develop. Today the great load of sediment carried by the Mississippi and its (now) Western tributaries have filled this embayment as far as the delta below New Orleans. The process is still continuing at a (geologically) rapid rate.

As erosion leveled the areas of high relief, the region was reduced to a plain of base level, called a peneplain. As the region was moderately uplifted from time to time, above the base level of erosion, the streams would again be able to cut down below the former plain level and carve the country into hills and valleys. But the ridgetops would retain a general level, representing remnants of an older peneplain surface, not yet completely worn away. Thus evidences of former peneplains are still preserved at several different levels in the Shawnee Hills, of which the most prominent, lying close to 700 feet above sea level, belongs to the last, or Salem-Lancaster Peneplain of late Tertiary age.

This peneplain is characterized in many places by the deposits of highly rounded and shiny surfaced chert gravels, called the LaFayette gravels, which are widely distributed from Louisiana to Wisconsin.

THE EFFECTS OF THE ICE AGE.

Just before the coming of the glaciers to open the Pleistocene Period (Ice Age), the region was uplifted several hundred feet and the dissection by streams of the Salem-Lancaster Peneplain surface began. At this time an ancestral Mississippi River lay to the west but nothing resembling the Ohio River existed. The region of southern Ohio was drained by a series of north-flowing streams.

As the glaciers moved down into the Lake Erie Basin and toward central Ohio, the streams were dammed to form lakes which rose until they spilled westward over rocky divides, to form a chain of lakes. As the waters of their outlets cut gorges through the rocky divides a continuous river eventually developed, which is the present Ohio. How and why the original Ohio Valley across southern Illinois is no longer used is already described in some detail under Stop 11.

There were four major stages of glaciation during the Ice Age, and only the third of these, the Illinoian got as far south as the Harrisburg Area. Thus the Shawnee Hills were never glaciated. However, as has been described in Part I, the glaciation had indirect effects in the alluviation of the major streams and the filling of tributaries with sediment to a like level, and in the deposition of wind-blown loess over the uplands. The net effect was to enrich the soil over important sections of the region.

Today, erosion is again in process of cutting down the region to a new base level at some immensely distant future date.

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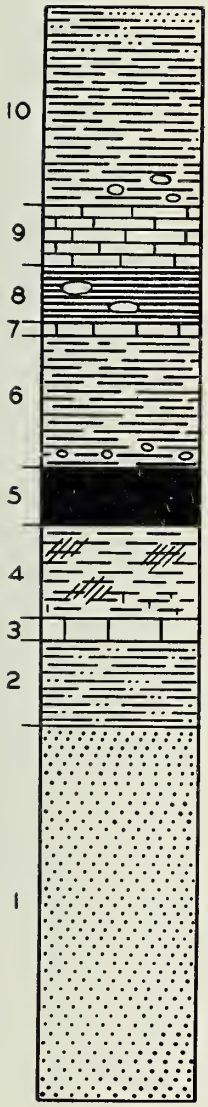


10 Shale, gray, sandy at top; contains marine fossils and ironstone concretions especially in lower part.

9 Limestone; contains marine fossils.

8 Shale, black, hard, laminated; contains large spheroidal concretions ("Niggerheads") and marine fossils.

7 Limestone; contains marine fossils.

6 Shale, gray; pyritic nodules and ironstone concretions common at base; plant fossils locally common at base; marine fossils rare.

5 Coal; locally contains clay or shale partings.

4 Underclay, mostly medium to light gray except dark gray at top; upper part noncalcareous, lower part calcareous.

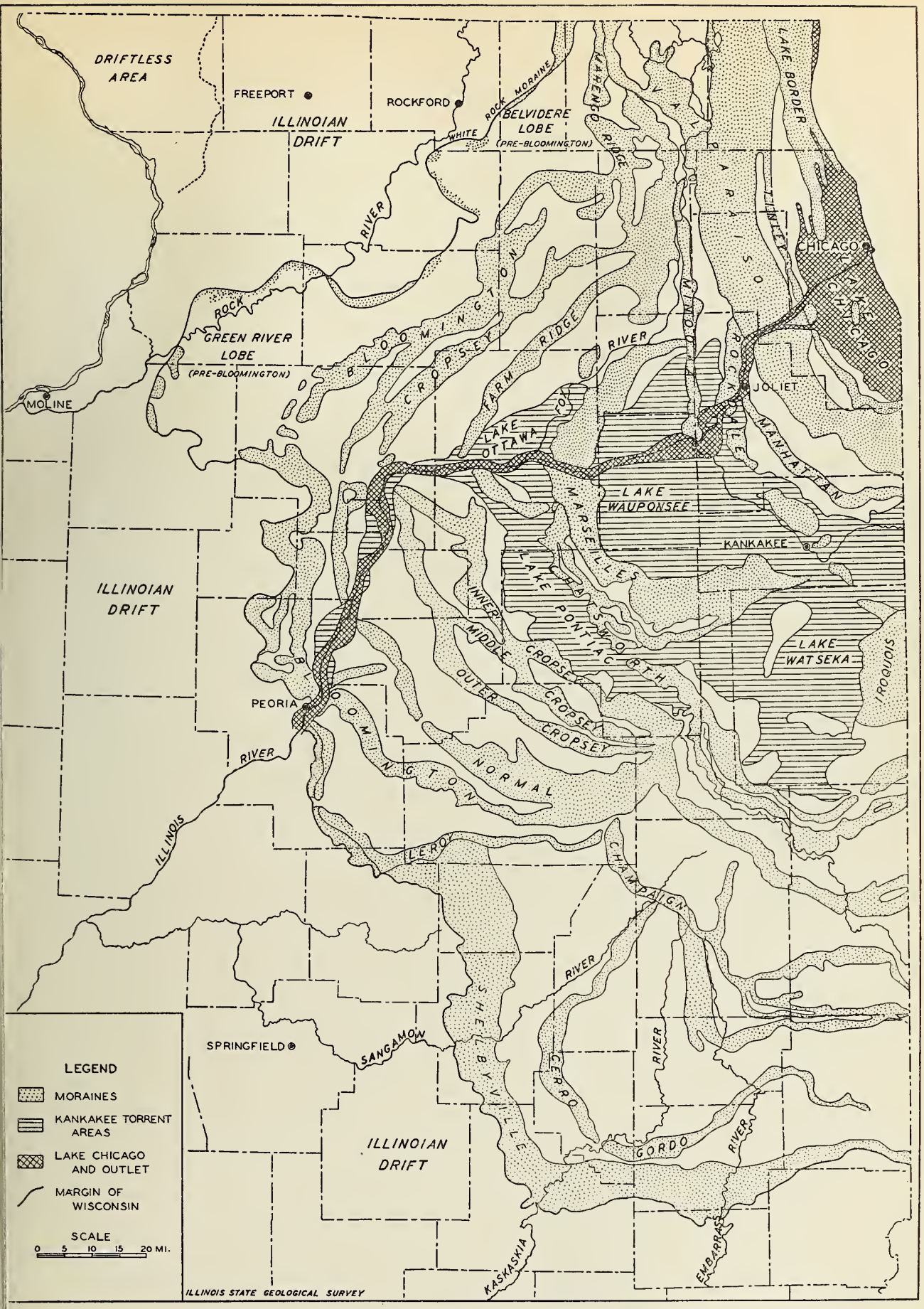
3 Limestone, argillaceous; occurs in nodules or discontinuous beds; usually nonfossiliferous.

2 Shale, gray, sandy.

1 Sandstone, fine-grained, micaceous, and siltstone, argillaceous; variable from massive to thin-bedded; usually with an uneven lower surface.

AN IDEALLY COMPLETE CYCLOTHEM

(Reprinted from Fig. 42, Bulletin No. 66, Geology and Mineral Resources of the Marseilles, Ottawa, and Streator Quadrangles, by H. B. Willman and J. Norman Payne)



GLACIAL GEOLOGY IN NORTHEASTERN ILLINOIS
Compiled by George E. Ekblaw from data furnished by the Survey
January 1, 1942

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